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INVENTOR-INFORMATION:

| NAME | COUNTRY |
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| ELLIS, ALAN ELGAR HERBERT | N/A |

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ABSTRACT:

CHG DATE=19990617 STATUS=O> A security wheel nut or bolt for a vehicle road wheel has a main body (10) provided with a polygonal drive portion (11). A sleeve (18) is rotatably mounted on the main body to surround with clearance the drive portion (11), the sleeve (18) having at least two inwardly-directed axially extending projections (21). A key (23) has a socket (26) engageable with the drive portion (11) and has a cylindrical external surface which fits within the clearance between the sleeve (18) and drive portion (11), the key having axial recesses (27) for receiving the projections (21). Security may be enhanced by providing three or more projections (21), with coded arcuate spacings therebetween, and by using drive portions (11) of different shapes and sizes.



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(71) Applicant: Ellis, Alan Elgar Herbert
14 Scott Drive Lexden
Colchester Essex CO3 5LE(GB)

(72) Inventor: Ellis, Alan Elgar Herbert
14 Scott Drive Lexden
Colchester Essex CO3 5LE(GB)

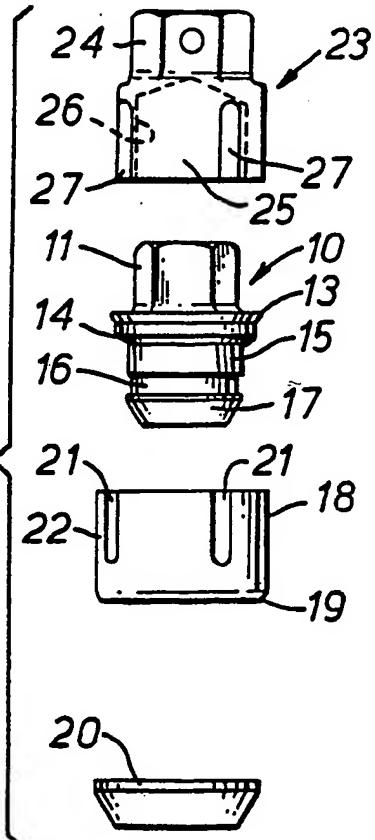
(74) Representative: Gilliam, Francis Cyril et al
SANDERSON & CO. European Patent
Attorneys 34, East Stockwell Street
Colchester Essex CO1 1ST(GB)

(54) Security wheel nut or bolt.

(57) A security wheel nut or bolt for a vehicle road wheel has a main body (10) provided with a polygonal drive portion (11). A sleeve (18) is rotatably mounted on the main body to surround with clearance the drive portion (11), the sleeve (18) having at least two inwardly-directed axially extending projections (21). A key (23) has a socket (26) engageable with the drive portion (11) and has a cylindrical external surface which fits within the clearance between the sleeve (18) and drive portion (11), the key having axial recesses (27) for receiving the projections (21).

Security may be enhanced by providing three or more projections (21), with coded arcuate spacings therebetween, and by using drive portions (11) of different shapes and sizes.

FIG. 3



SECURITY DRIVE ASSEMBLIES

This invention relates to a security drive assembly for a rotatable member such as a nut or bolt head, arranged so that it is very difficult to turn the rotatable member other than by the means of an appropriate key.

Not infrequently, it is desired to make a rotatable member secure against unauthorised operation, so that the member cannot be turned other than by a person in possession of a key individual to that rotatable member. For example, in the case of the road wheels of a motor vehicle, these are usually secured in position on a hub by means of nuts threaded on to studs projecting from the hub or by bolts screwed into threaded bores provided in the hub. It is known to prevent the unauthorised removal of the wheel by providing at least one security nut or bolt which is configured to resist unscrewing other than by using a special, individual key for that nut or bolt. One common arrangement has the nut or bolt head shaped so as to have a particular non-hexagonal profile which is drivingly engageable solely by means of a complementarily-formed key. For example the nut or bolt head may essentially be cylindrical or conical, but provided with a plurality of spaced recesses extending parallel to the axis and into which pins projecting from a key may engage. However, such nut or bolt heads are relatively easy to release using conventional tools such as universal grips, wrenches and so on, especially if suitable pegs are first pushed into the recesses: these devices thus offer relatively low security.

In an attempt to improve the security of the wheel nuts or bolts as described above, it is known to provide a rotatable shroud on the nut or bolt, to surround the portion of the nut or bolt head which is turned by the key, so greatly restricting access to the nut or bolt head. It is further known to provide radial projections on the specially-shaped nut or bolt head at certain predetermined angular spacings, and to provide appropriately positioned recesses in the driving key for receiving those projections, so as to increase the number of key-combinations available for a given special design of nut or bolt head. It is however still found that the number of combinations available is too limited for high security, given a particular thread (and hence nut or bolt head) size. Moreover, the manufacturing processes needed for such designs of security nuts or bolt heads are complex and require considerable accuracy to ensure proper coding of the projections, so leading to significant costs.

It is a general aim of the present invention to provide an improved form of security drive assembly suitable for use for example to secure a wheel nut or bolt against all but the most determined attempts at unauthorised removal, which improved security assembly at least reduces the disadvantages mentioned above for the known assemblies. More specifically, the invention consists of an improvement in the kind of security drive assembly for a rotatable member, comprising a drive portion on the rotatable member which drive portion is accessible axially from one end of the drive member and has a non-circular cross-sectional shape, a sleeve rotatably mounted on the rotatable member at a location remote from said one end of the rotatable member and surrounding with clearance substantially the whole axial extent of the drive portion, and a key having an axially-extending socket which has a complementary shape to that of the drive portion, the external shape of the key in the region of the socket being circular and adapted to fit within said clearance defined between the sleeve and the drive portion when the socket is engaged with the drive portion.

Accordingly, this invention provides a security drive assembly of the kind described, which is characterised by the sleeve being provided with at least two inwardly-directed arcuately-spaced projections and by the external surface of the key having a like number of correspondingly-spaced recesses in which said projections on the sleeve are received as the key is engaged with the rotatable member.

It will be appreciated that the security drive assembly of this invention particularly lends itself for use in connection with a nut or bolt head, especially where the nut or bolt is to serve to retain a vehicle road wheel to a hub of the vehicle. For such an arrangement, the rotatable member, as a whole, comprises the wheel nut or wheel bolt; the sleeve should be rotatably mounted on the nut or bolt immediately adjacent that part which engages the wheel, when in use, so permitting axial access to the drive portion by the key.

A particular advantage of the present invention is that the rotatable member itself may be essentially conventional, having regard to the intended use of the security drive arrangement. Thus, the drive portion may be of hexagonal shape, with the socket of the key similarly formed; where the rotatable member serves as a wheel nut or bolt, the size of the hexagon may be the same as that of the other wheel nuts or bolts. It will be appreciated that despite this, security will be enhanced by providing drive portions of other non-circular cross-sectional

shapes. For example, drive portions of septagonal, octagonal, nonagonal or of any other polygonal cross-sectional shape may be employed. Other possibilities include the use of fluted, splined or star-shaped drive portions, in each case with the possibility of using various numbers of flutes, splines, points or the like. In this way, very large numbers of different, individually keyed assemblies may be provided, without the need to employ complex and accurate coding of projections on the drive portion.

In the present invention, such coding of a key as may be required so as to render the key individual for a particular rotatable member is performed as between the key and the rotatable sleeve, by providing inwardly directed projections on the sleeve which projections must be received in correspondingly formed recesses in the external surface of the key, as the key is engaged with the rotatable member. At least two such projections spaced arcuately round the sleeve should be provided, though advantageously three or more arcuately-spaced projections are employed. The axial position of such projections within the sleeve advantageously is such that, other than when the projections are being received within the corresponding recesses in the external surface of the key, no significant engagement of the socket within the key may be achieved with the drive portion. In this way, no turning force may be imparted to the rotatable member in the event that the key does not have appropriately-positioned recesses to receive the projections within the sleeve. Most preferably, however, in order to assist an interengagement of the key with both the sleeve and the drive member, the axial position of the projections is such that the projections must be partially received within the appropriately-positioned recesses in the key prior to any interengagement taking place as between the socket in the key and the drive portion of the rotatable member.

Though the invention has primarily in the foregoing been discussed with reference to wheel nuts or bolts, it will be understood that the invention is applicable to various other circumstances where a rotatable member is to be secured against unauthorised turning movement. For example, mention may be made of the securing of the turning member of a fluid-flow control valve, to ensure that the valve is not operated by others than those properly authorised and so in possession of the appropriate key.

By way of example only, two specific embodiments of security drive assembly according to this invention will now be described in detail, reference being made to the accompanying drawings which

show a vehicle road wheel security nut and a vehicle road wheel security bolt, both arranged in accordance with this invention.

In the drawings:

Figure 1 is a side view, partly in section, showing the embodiment of wheel nut of this invention;

Figure 2 is a plan view on the wheel nut of Figure 1;

Figure 3 is an exploded view of the assembly of Figure 1, but also showing the associated key;

Figure 4 shows a clip for mounting the key on a vehicle wheel brace;

Figures 5 and 6 respectively show a side view, partly in section, and a plan view of the embodiment of wheel bolt of this invention; and

Figures 7 and 8 are an end view and a side view of a modified form of key for use with the nut or bolt.

Referring initially to Figures 1 to 3, it can be seen that the vehicle wheel nut according to this invention comprises a main body 10 including a septagonal drive portion 11 and a threaded bore 12 adapted to interengage with a threaded stud projecting from a vehicle wheel hub (not shown). The drive portion 11 adjoins a flange 13, itself adjoining a cylindrical portion 14. Adjacent the cylindrical portion 14 are two further cylindrical portions 15 and 16, each of a lesser diameter than the preceding portion, the main body 10 having at its end opposed to the drive portion 11 a conical portion 17, adapted for interengagement with a conical recess in a wheel, around the stud-hole therein.

Rotatably mounted on the main body 10 is a sleeve 18, generally of cylindrical shape but having an inturned lip 19 defining a circular opening adapted to be a free running fit on the cylindrical portion 14, the flange 13 serving to locate the sleeve 18 to surround with clearance the drive portion 11. The sleeve 18 is retained in position by means of a conical washer 20, press-fitted on to cylindrical portions 15 and 16 of the main body 10, the conical washer 20 having an external conical face which is substantially aligned with the conical face of conical portion 17 of the main body 10, when the conical washer has been pressed fully home as illustrated in Figure 1, also for engagement with a conical recess in a wheel.

From Figure 2, it can be seen that the sleeve 18 has three inwardly directed projections 21, each of these being defined by the material of the sleeve side wall being deformed inwardly. The positions of the projections around the sleeve are coded to have pre-determined spacings, and each projection extends from the end face 22 of the sleeve parallel to the sleeve axis towards the lip 19, for approximately one half of the length of the sleeve.

Figure 3 illustrates a key 23 adapted for use in connection with the wheel nut of Figures 1 and 2. This key has a hexagonal portion 24, preferably of the same size as the conventional wheel nuts of a motor vehicle to which the wheel nut of this invention is to be fitted, so that only a single spanner or wheel brace need be employed to release the road wheel. The key 23 also has a cylindrical portion 25 within which is formed an axially extending socket 26 of a complementary shape and size to the septagonal drive portion 11 of the main body 10, the diameter of the cylindrical portion 25 being essentially the same as the inner diameter of the sleeve 18. Three recesses 27 (only two of which can be seen in Figure 3) are formed in the circumferential wall of the cylindrical portion 25, the arcuate spacing between the recesses 27 and their axial length corresponding to the spacing and dimensions of the projections 21 of the sleeve 18, so that the key 23 may be received within the sleeve 18, by interengaging the projections 21 with the respective recesses 27.

As will be appreciated from Figure 1, the end face 22 of the sleeve 18 projects beyond the end of the drive portion 11 of the nut main body 10, so that the projections 21 must first be engaged with the recesses 27 of the key 23, if the drive portion 11 is to be driven by the key. Then, after engaging the key 23 within the sleeve 18, the key and sleeve 18 must together be turned until the orientation of the socket 26 of the key corresponds to that of the drive portion 11; thereafter, the key may be slid axially so as fully to engage the socket 26 with the drive portion 11, whereafter further rotation of the key will turn the drive portion 11.

It will be appreciated that the drive portion 11 cannot be turned other than by a key having a socket suitable to engage and drive the drive portion 11 and also having an outer cylindrical surface 25 provided with suitably-disposed recesses 27 to accommodate the projections 21 of the sleeve 18. The arcuate spacing of the three projections 21 should be coded, and so different as from one nut to another, though four nuts of one coding may be provided for one vehicle, one such nut for each wheel. In this way, a key 23 adapted for use with one particular nut will only fit those nuts as have the same coded spacings between the projections on the sleeve 18, and the same shaped drive portion. By providing drive portions of different configurations, and keys with complementarily-formed sockets 26, a very large number of possible key codings can be obtained. In this connection, mention may be made of the possibilities of providing a drive portion 11 which is essentially cylindrical in shape, but has a single driving flat thereon or possibly a pair of driving flats disposed at some pre-determined angular interval, or of drive portions

of pentagonal, septagonal, or nonagonal shape. Other possibilities for the drive portion 11 are to have a splined or fluted shape, or a star-shaped form, in each case with the possibility of different numbers of splines, flutes or points.

When the key illustrated in Figure 3 is not required for use, it is convenient to store it in close proximity to the wheel wrench employed to release the wheel nuts and also to turn the key itself. Figure 4 shows a spring clip 30 which may be used to hold the key 31 to the rod-like shaft 32 of a typical motor vehicle wheel brace.

Figures 5 and 6 show a security bolt for use with a vehicle having bolts to hold the wheels to the hubs. The bolt is generally similar to the nut described with reference to Figures 1 and 2; like parts are given like reference characters and will not be described again. In the bolt of Figures 5 and 6 the main body 35 has a septagonal drive portion 11, but depending from that drive portion is an externally threaded bolt 36, on which is rotatably mounted a conical washer 37, retained in a groove 38 on the bolt. In other respects the bolt corresponds to the nut of Figures 1 and 2 and is engageable by a similar key.

Figures 7 and 8 show a modified form of key for use with the nut or bolt described above. This key 40 has a hexagonal portion 41 contiguous with a cylindrical portion 42 in which there are formed external recesses 43 for interengagement with the projections 21 in sleeve 18, the portion 42 also having a septagonal recess 44 for engagement with the drive portion of a wheel nut or bolt. The axis of the hexagonal portion 41 is however offset from the axis of the cylindrical portion 42. This is done to ensure that should an attempt be made to defeat the security system by reducing the wall thickness of the cylindrical portion until the cylindrical portion may turn within the projections 21, by holding the hexagonal portion in the chuck of a lathe, and machining the wall of the cylindrical portion, the integrity of the cylindrical portion will be destroyed, leading to insufficient strength to permit the release of a wheel nut or bolt.

Claims

1. A security drive assembly for a rotatable member, comprising a drive portion (11) on the rotatable member (10) which drive portion is accessible axially from one end of the drive member and has a non-circular cross-sectional shape, a sleeve (18) rotatably mounted on the rotatable member (10) at a location remote from said one end of the rotatable member and surrounding with clearance substantially the whole axial extent of the drive portion (11), and a key (23) having an axially-

extending socket (26) which has a complementary shape to that of the drive portion (11), the external shape of the key (23) in the region of the socket being circular and adapted to fit within said clearance defined between the sleeve and the drive portion when the socket (26) is engaged with the drive portion (11) characterised in that the sleeve (18) is provided with at least two inwardly-directed arcuately-spaced projections (21) and in that the external surface (25) of the key (23) has a like number of correspondingly-spaced recesses (27) in which said projections (21) on the sleeve are received as the key is engaged with the rotatable member.

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2. A security drive assembly according to claim 1, characterised in that the rotatable member comprises a nut or bolt for use in retaining a vehicle road wheel to a hub of the vehicle.

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3. A security drive assembly according to claim 1 or claim 2 further characterised in that the drive portion 11 of the rotatable member (10) is of polygonal shape, with the socket (26) of the key (23) similarly formed.

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4. A security drive assembly according to claim 1 or claim 2 further characterised in that the drive portion (11) of the rotatable member (10) is of a fluted, splined or star-shaped configuration, with the socket (26) of the key (23) similarly formed.

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5. A security drive assembly according to any of the preceding claims, characterised in that the axial position of the projections (21) on the sleeve (18) is such that the projections (21) must be partially received within the appropriately-positioned recesses (27) in the key (23) prior to any interengagement taking place being the socket (26) in the key (23) and the drive portion (11) of the rotatable member (10).

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6. A security drive assembly according to any of the preceding claims, further characterised in that there are at least three projections (21) provided in the sleeve (18) and engageable with the recesses (27) in the key (23).

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7. A security drive assembly according to any of the preceding claims, characterised in that the sleeve (18) projects axially beyond the end of the drive portion 11 of the rotatable member (10).

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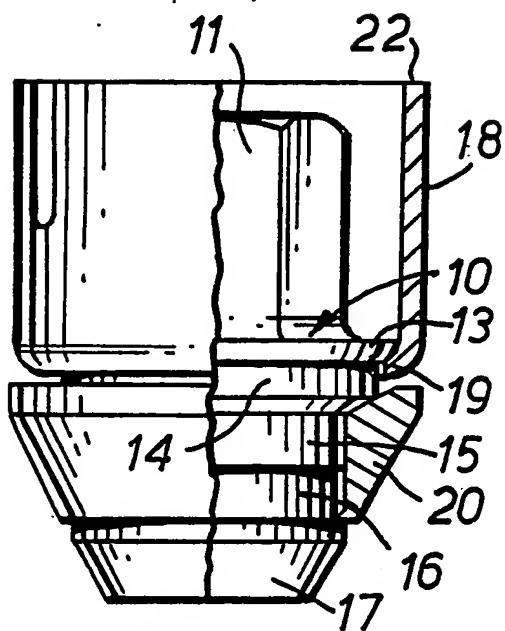
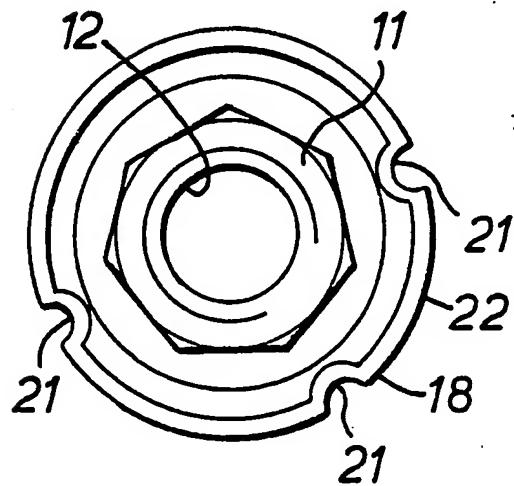
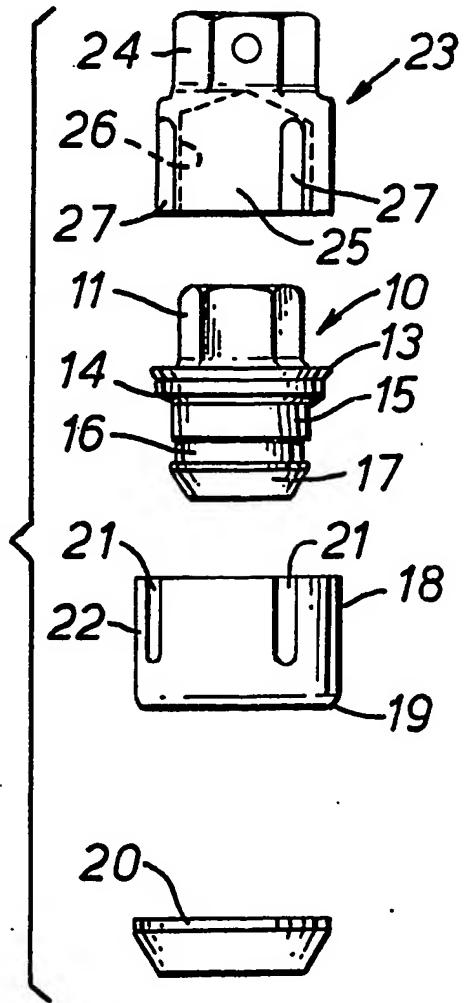
8. A security drive assembly according to any of the preceding claims, characterised in that the key (23) has a hexagonal drive portion (24) adjoining the cylindrical portion (25) thereof.

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9. A security drive assembly according to claim 8, characterised in that the axis of the hexagonal drive portion (24) of the key (23) is off-set from the axis of the cylindrical portion (25).

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FIG. 1**FIG. 2****FIG. 3**

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FIG. 4

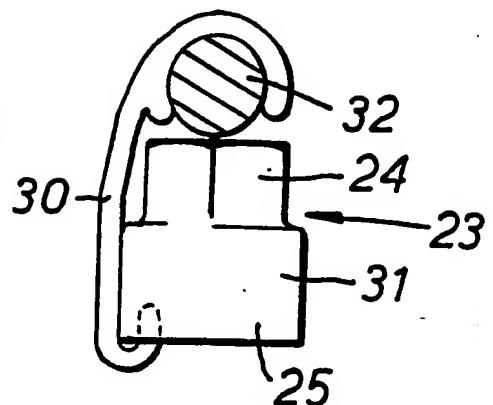


FIG. 5

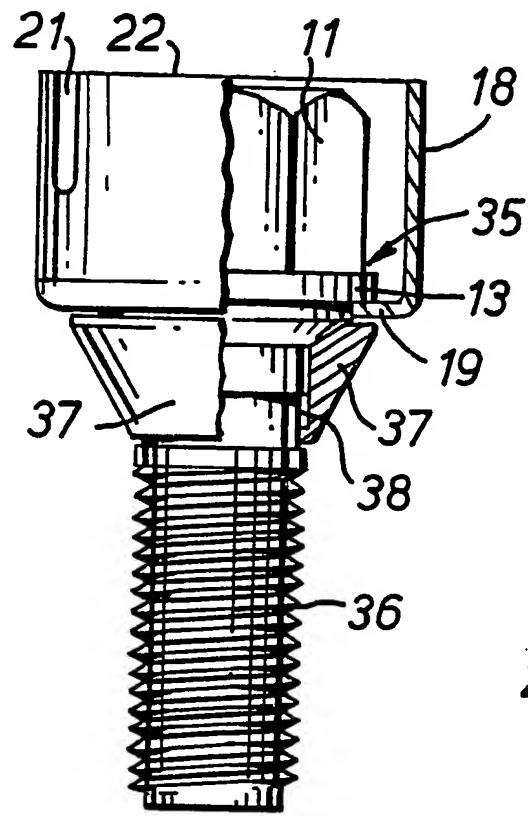
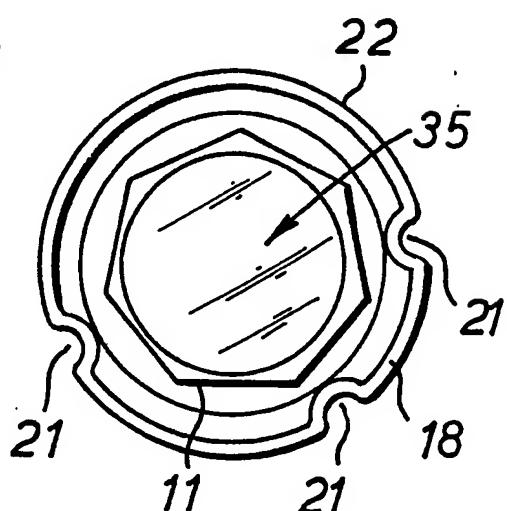


FIG. 6



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FIG. 7

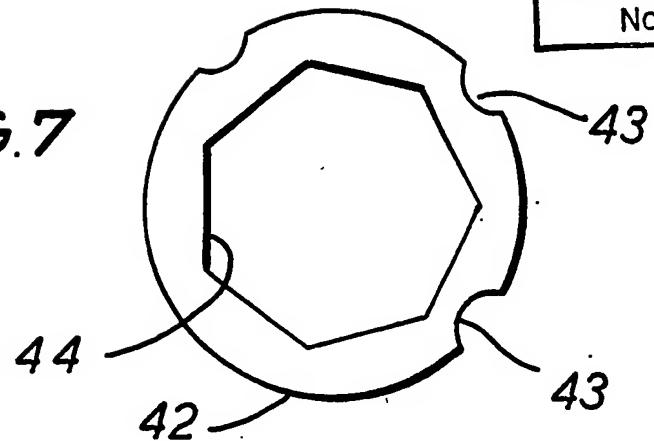
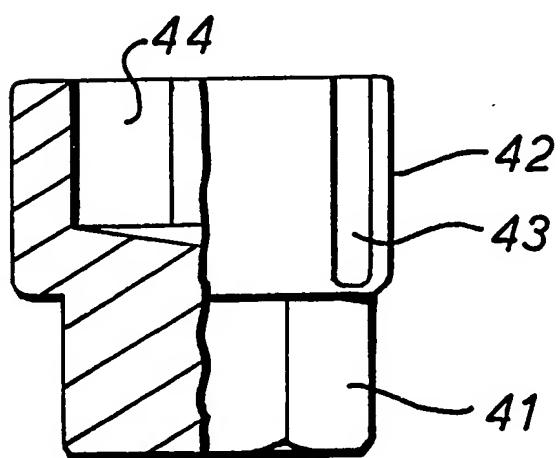


FIG. 8





European Patent
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EUROPEAN SEARCH REPORT

Application number

EP 87 30 5167

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | CLASSIFICATION OF THE APPLICATION (Int. Cl.4) |
|--|--|-------------------|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | |
| X | US-A-4 205 825 (Y. YAMADA) * column 2, lines 48-54; column 3, lines 51-68; column 4, lines 1-10, 20-26, 46-50; column 6, lines 66-68; column 7, lines 1-5, 29-42; figures 1-3 * | 1,3,5, 7 | F 16 B 41/00 B 60 B 3/16 |
| Y | --- | 2,4,8 | |
| Y | FR-A- 934 482 (AMBERT) * totality * | 2,8 | |
| Y | --- | 4 | |
| Y | EP-A-0 087 721 (RAPPOLD) * page 2, lines 23-32; page 3, lines 1-10; figures 1-18 * | | |
| Y | --- | 8 | |
| Y | US-A-1 447 564 (NORLUND et al.) * page 2, lines 52-69; figure 5 * | | F 16 B 23/00 F 16 B 41/00 F 16 K 35/00 B 60 B 3/16 |
| A | --- | 9 | |
| A | DD-A- 210 728 (VEB WERKZEUGKOMBINAT SCHMALKALDEN) * page 5, lines 15-22; page 6, lines 6-8; figure 2 * | | |
| A | --- | | |
| A | DE-A-1 919 340 (ELLIS COLCHESTER LTD.) ----- | | |
| The present search report has been drawn up for all claims | | | |
| Place of search | Date of completion of the search | Examiner | |
| BERLIN | 28-10-1987 | HEINLEIN | |
| CATEGORY OF CITED DOCUMENTS | | | |
| X : particularly relevant if taken alone | T : theory or principle underlying the invention | | |
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